## REMARKS

Reconsideration and allowance of the subject application are respectfully requested. Claims 1-19 and 21-25 remain pending, claims 8, 13, and 14 having been withdrawn from consideration as being directed to a non-elected invention. Of the claims under consideration, claims 1, 10, 15, and 19 are independent.

In this Reply, Applicants have submitted evidence, in the form of a Declaration, as suggested by the Examiner on page 11 of the Office Action. Applicants respectfully request that the Examiner reconsider claims of the present application in view of this evidence and the remarks set forth below.

### Prior Art Rejections

1. § 103 Rejection: *Beck* - "Cold Heading" - *Miller* - *Rateick '475*

Claims 1-6, 9-12, 15-18, and 23-25 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over *Beck et al.* (DE 19652326) in view of cited portions of Metal Handbook, 9th Ed. ("Cold Heading"), and further in view of *Miller* (U.S. Patent 3,890,106) and *Rateick, Jr.* (U.S. Patent 5,728,475, hereinafter "*Rateick* '475"). This rejection is respectfully traversed.

The Manufacturing Method of Independent Claim 1

Independent claim 1 is directed to a method of manufacturing a wear resistant shoe. The method of claim 1 comprises: cold-heading one end portion of a generally cylindrical blank to radially increase and axially diminish the dimensions of the one end

portion, and to work harden the one end portion while leaving an opposite end portion dimensionally unchanged and maintaining cold-workability of the opposite end portion; machining the previously cold-headed one end portion to form a cam engaging portion of said wear resistant shoe; and subsequently cold-working and thereby hardening the opposite end portion.

Thus, as previously emphasized, a feature of the method of manufacturing a wear resistant shoe recited in claim 1 is a step of cold-heading one end portion of a generally cylindrical blank to work harden the one end portion while leaving an opposite end portion dimensionally unchanged and while maintaining cold-workability of the opposite end portion. The opposite end portion is subsequently cold-worked. As described in the specification at pg. 5, line 4 - pg. 6, line. 18, the cold-heading step achieves work hardening of an end portion 38, which comprises the material making up the balance land 28 and the back flange 34 of the wear resistant shoe, to a substantial depth. In addition, the cold-heading step is performed so as to leave the opposite end portion 40, which comprises material making up the skirt 50, in a dimensionally unchanged and unhardened state. Thus, the skirt portion is maintained in a softened condition until work hardening during the subsequent crimping process, thereby allowing the skirt 50 to be crimped without cracking.

The Primary Reference

*Beck* discloses a technique for manufacturing a shoe for an axial piston machine. As described in the previously-submitted partial English translation, *Beck* relies on a forging process to generate an intermediate product 1. In the first embodiment shown in Fig. 1, the forging process results in an intermediate product (i.e., forging) 1 having a recess 10 and an outer contour 2, which is subsequently machined to a finished part contour 3 having a finished recess 10'. The second, third, and fourth embodiments, illustrated in Figs. 2, 3, and 4, respectively, generate forgings for two parts 4.1, 4.2. In the second embodiment of Fig. 2, the intermediate product 1 includes a pair of recesses 10, whereas the embodiments of Fig. 3 and Fig. 4 do not include a formed recess 10, which is subsequently formed by machining.

In all embodiments of *Beck*, however, it is evident that the forging process used to produce the intermediate product 1 would result in substantial work hardening of the portions used to form the "glide face" 14 and the region for forming the recess (i.e., socket region). In other words, there is no apparent attempt in *Beck* to maintain cold-workability of the socket region.

The Asserted Combination of References

The grounds of rejection acknowledges differences between the manufacturing method of *Beck* and that of claim 1, but relies on the

teachings of "Cold Heading," *Miller*, and *Rateick* '475 to conclude that:

> [I]t would have been obvious to one of ordinary skill in the art to have made the blank "2" of *Beck* et al by the process of cold heading a generally cylindrical blank because cold heading provides several advantages including leaving almost no waste material and also increased strength due to the cold working (i.e.-work harden). (Office Action, pg. 3).

Deficiencies in the Asserted Rejection

As discussed in previous Replies, "Cold Heading" describes materials, equipment, characteristics, etc., of cold heading as a manufacturing process. Although this reference describes using cold-heading for manufacturing items such as bolts and rivets, there is no description or suggestion of using cold-heading in the manufacture of a wear resistant shoe, particularly in the manner recited in claim 1.

As set forth on page 3 of the Office Action, the rejection relies on *Miller* as suggesting "the desirability of cold forming only a portion of a blank material so that the underformed portion remains soft for subsequent forming operations." Regarding *Miller*, Applicants note that the element being manufactured is not a wear resistant shoe of the type claimed. Furthermore, *Miller* describes a process of cold work hardening metallic extrusions (preferably brass), but does not describe a cold-heading process and certainly does not describe or suggest cold-heading for manufacturing a wear resistant shoe in the manner recited in claim 1.

Applicants further submit that neither "Cold Heading" nor *Miller* suggest a modification of the manufacturing technique disclosed by *Beck* that would result in the particular technique for manufacturing a wear resistant shoe recited in claim 1. As mentioned above, the forging process used to make the intermediate product (i.e., forging) 1 of *Beck* would achieve substantial work hardening of the portions used to form the "glide face" 14 and the region for forming the recess (i.e., socket region). Thus, the dies used in the forging embodiments described in *Beck* were not designed to maintain cold-workability of the end portion for the socket region, and any modification of the forging embodiments disclosed by *Beck* to satisfy this feature of the claimed invention would at least require a significantly different die design than those used therein. Particularly considering the lack of concern for maintaining cold-workability of the end portion for the socket region in *Beck*, it cannot be said that such a re-design of the *Beck* forging process is suggested by the art of record.

In further support of Applicants' position that the applied prior art fails to establish obviousness of the claimed invention, a Declaration is provided concurrently herewith. This Declaration provides a detailed discussion of the state of art at the time of the invention and how the manufacturing method of claim 1 departed from the prior art at the time. In particular, Applicants direct the Examiner's attention to paragraphs 11.-13., describing

conventional piston shoe manufacturing technology and Applicants' development of the claimed technique to address specifically-identified drawbacks. Applicants solicit the Examiner's consideration of the attached Declaration.

To establish *prima facie* obviousness, all claim limitations must be taught or suggested by the prior art and the asserted modification or combination of prior art must be supported by some teaching, suggestion, or motivation in the applied reference or in knowledge generally available to one skilled in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). The prior art must suggest the desirability of the modification in order to establish a *prima facie* case of obviousness. *In re Brouwer*, 77 F.3d 422, 425, 37 USPQ2d 1663, 1666 (Fed. Cir. 1995). It can also be said that the prior art must collectively suggest or point to the claimed invention to support a finding of obviousness. *In re Hedges*, 783 F.2d 1038, 1041, 228 USPQ 685, 687 (Fed. Cir. 1986); *In re Ehrreich*, 590 F.2d 902, 908-09, 200 USPQ 504, 510 (CCPA 1979).

The objective evidence of record does not establish that somehow modifying the manufacturing process of *Beck* to include cold heading would result in an inherent and significant reduction in waste material (as asserted in the rejection), particularly to an extent that would more than offset any drawbacks in die redesign cost/complexity, ease of manufacturing, etc. that may result from

such a modification. In short, there is no evidence pointing to the modification of *Beck* relied on by the Examiner to assert obviousness of claim 1. Furthermore, it appears that the asserted modification of *Beck* would fundamentally change the manufacturing process described therein, which supports the conclusion that the asserted modification is not obvious. See e.g., MPEP § 2143.01. The Examiner's reliance on *Rateick* '475 does not make up for this fundamental deficiency of the rejection.

Applicants respectfully submit that the reasoning provided to assert a combination of *Beck*, "Cold Heading", *Miller*, and *Rateick* '475 fails to establish *prima facie* obviousness of independent claim 1 or any claim depending therefrom. Applicants also submit that independent claims 10 and 15, as well as all claims depending therefrom, distinguish over the asserted combination at least based on similar reasoning to that set forth above with regard to claim 1.

In view of the above, Applicants respectfully request reconsideration and withdrawal of the Examiner's rejection under 35 U.S.C. § 103 based on the asserted combination of *Beck*, "Cold Heading", *Miller*, and *Rateick* '475.

2. § 103 Rejection: *Beck* - "Cold Heading" - *Miller* - *Rateick* '475 - *Harada*

Claim 7 stands rejected under 35 U.S.C. § 103 as allegedly being unpatentable over *Beck* in view of "Cold Heading", *Miller*, *Rateick* '475, and *Harada* (JP 56-084468). This rejection is respectfully traversed.

As stated on page 7 of the Office Action, the Examiner relies on *Harada* as allegedly teaching incremental features of dependent claim 7. Applicants respectfully submit, however, that the Examiner's reliance on *Harada* fails to make up for the deficiencies of the asserted combination of *Beck*, "Cold Heading", *Miller*, and *Rateick* '475 discussed above with reference to claim 1. Therefore, Applicants respectfully submit that the asserted modification of *Beck* in view of "Cold Heading", *Miller*, *Rateick* '475, and *Harada* (assuming these references may be combined, which Applicants do not admit) fails to establish *prima facie* obviousness of claim 7, which indirectly depends from claim 1. In view of the above, Applicants respectfully request reconsideration and withdrawal of the Examiner's rejection under 35 U.S.C. § 103 based on the asserted modification of *Beck* in view of "Cold Heading", *Miller*, *Rateick* '475, and *Harada*.

3. *Rateick '475 - Davidson*

Claims 19, 21, and 22 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over *Rateick* '475 in view of *Davidson* (U.S. Patent 4,003,765). This rejection is respectfully traversed.

Independent claim 19 is directed to a method of forming and assembling a piston and wear resistant shoe, the shoe being formed from hardened rod stock. The method of claim 19 comprises: machining a region of the hardened rod stock to form a cam engaging wear resistant surface of the wear resistant shoe; forming a hollow region in one rod stock end portion; annealing the one end portion of the rod stock; and crimping the periphery of the hollow region about a rounded end of the piston rod.

As described in the Background section of the present application, *Rateick* '475 describes a technique for manufacturing a piston shoe 10 having a skirt/flange area 16 formed to the shape of a piston head 18, a wear surface 12 and back flange 14, which engage and wear on a cam plate 22 and auxiliary cam plate 24, respectively. The technique disclosed in *Rateick* '475 is not specific to forming and assembling a piston and wear resistant shoe using hardened rod stock as the starting material for forming the shoe. Thus, with reference to claim 19, *Rateick* '475 does not machine a region of hardened rod stock to form a cam engaging wear resistant surface of the wear resistant shoe.

The secondary reference, *Davidson*, discloses a technique for heat treating cobalt based alloys. *Davidson* does not relate to a method of forming and assembling a piston and wear resistant shoe. In rejecting independent claim 19, the Examiner asserts on pages 8-9 of the Office Action that:

> it would have been obvious to one of ordinary skill in the art to have utilized hardened material, such as that of Davidson, as the starting material, because it starts with an increased hardness (thus, providing more wear resistance) while maintaining sufficient ductility to be processed further.

For *Rateick* '475, however, the manufacturing process described therein is based on using a starting material with cold workability. *See e.g.*, col. 2, lines 14-17, stating that "it is necessary for the piston shoe 10 to be corrosion resistant, compatible with aircraft fuel, provide the desired wear resistance, and provide the cold workability of a portion of the shoe." Thus, although Applicants do not dispute that a hardened starting material has increased hardness over a soft starting material, such a characteristic is deliberately avoided in the starting material for the process of *Rateick* '475.

At least in view of the above, Applicants respectfully request reconsideration and withdrawal of the Examiner's rejection under 35 U.S.C. § 103 based on the asserted combination of *Rateick* '475 and *Davidson*.

## Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

Applicants respectfully petition for a two (2) month extension of time pursuant to 37 C.F.R. §§ 1.17 and 1.136(a). A check in the amount of $420.00 in payment of the extension of time fee is attached.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By _____
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DRA/jdm
2929-0184P

Attachment: Declaration Under 37 C.F.R. § 1.132

PATENT
2929-0184P

IN THE U.S. PATENT AND TRADEMARK OFFICE

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|---|---|---|---|
| Applicant: | R.G. RATEICK, JR. et al. | Conf.: | 8033 |
| Appl. No.: | 09/896,261 | Group: | 1742 |
| Filed: | June 29, 2001 | Examiner: | H. WILKINS III |
| For: | SELECTIVELY COLD WORKED HYDRAULIC MOTOR/PUMP SHOE | | |

**DECLARATION UNDER 37 C.F.R. § 1.132**

1. I, RICHARD G. RATEICK, JR., a resident at the address of 18519 Beach Way, South Bend, Indiana 46637, USA, declare and state that:

2. I am presently employed by Honeywell International Inc., South Bend, Indiana;

3. In 1986, I graduated from Valparaiso University with a Bachelors degree in Mechanical Engineering and a second major in Chemistry;

4. In 1995, I graduated from The University of Notre Dame with a Master of Science in Materials Science and Engineering;

5. Since 1987, I have been employed by Honeywell International Inc., in South Bend, Indiana (hereinafter "Honeywell"). From the start of employment in 1997 until 1999, my

assigned Division was part of AlliedSignal, Inc., which merged with Honeywell in 1999. During my employment with Honeywell, I have primarily been engaged in research and development for aerospace engines and related systems. More specifically, I lead metals and ceramics research and development for hydromechanical propulsion control products. I am a registered Professional Engineer in the state of Indiana;

6. In view of my education and experience, I believe that I represent a person having at least ordinary skill in the materials aspects of the art of fuel motor and pump design;

7. I am familiar with the above-identified patent application filed June 29, 2001, including the pending claims of the above-identified application;

8. I am familiar with U.S. Patent 5,728,475 ("the '475 patent"), which issued March 17, 1998. Furthermore, being the inventor of the '475 patent, I consider myself to be qualified to discuss what this document would and would not have suggested to those having ordinary skill in the art of fuel motor and pump design;

9. I am familiar with each of the other references relied on by the USPTO's Examiner to reject the pending claims, specifically, *Beck et al.* (DE 19652326), *Miller* (U.S. Patent 3,890,106), *Harada* (JP 56-084468), and *Davidson* (U.S. Patent 4,003,765);

10. I have been presented with the following facts regarding the claims of the present application:

The Examiner at the United States Patent and Trademark Office ("USPTO") asserts, regarding independent claim 1, that one having ordinary skill in the art would have found it obvious to modify the manufacturing technique described in *Beck et al.* (DE 19652326) to utilize a cold-heading technique as claimed in the manufacture of a wear resistant shoe of the type set forth in the claim. Similar reasoning has been set forth in the Office Action for other claims. As evidenced by the facts below pertaining to my experience in adopting a cold-heading technique for the manufacture of a wear resistant shoe of the type recited in the claim, I disagree that one of ordinary skill in the art would have been motivated to make such an alteration of *Beck* at the time of our invention;

11. Conventionally, piston shoes are manufactured from steel or bronze, the former being used for when higher strength is required. The steel shoes employ wear surfaces of bronze applied by a variety of processes. Thus, the steel acts as the structure and the bronze acts as the wear surface. Bronze alloys are copper based. Copper will dissolve in jet fuel and will also enter into various chemical reactions with the fuel. Dissolved copper, besides affecting the integrity of the part, precipitates in down stream areas of the fuel system and can result in system failure. Steel used in fuel systems must be corrosion resistant. Thus, the steels normally used in shoes for hydraulic oil service are not appropriate for use in fuel. Thus, in addition to the standard requirements for a shoe material consisting of high strength, cold workability, and wear resistance the fuel environment adds the requirements of corrosion resistance and fuel compatibility. This severely limits the candidate material choices.

12. In a preferred implementation, we selected Haynes 25 (AMS 5759) for fuel motor and pump shoes on the basis of its fuel compatibility, cold workability, corrosion resistance and wear resistance. In a previous design represented in the '475 patent, the Haynes 25 was used in the solution annealed bar form and the process of crimping the shoe to the piston gave rise to work hardening in the crimped region. This work hardening together with the inherent wear resistance of the Co based alloy gave rise to the requisite wear resistance at the piston to shoe interface. The shoe balance land and back flange were subsequently coated using a thermal diffusion boride process. The resulting coating demonstrated sufficient wear resistance for the models to which it was applied.

However, we have recognized through additional experience that, for more demanding applications, an improved wear couple may be desirable. In particular, we observed that the boride coating tended to crack under certain conditions and concluded that this resulted because the hard thin boride coating was insufficiently supported by the soft basis metal. In addition, some operating conditions caused wear-through of the coating. This recognition of a particular problem with the previously described shoe manufacturing technique ultimately led us to the invention now claimed.

More specifically, having recognized the aforementioned drawbacks under certain conditions, we considered alternative manufacturing techniques that would possibly provide sufficient wear resistance under extreme operating conditions. An approach we ultimately adopted was selectively cold working the balance land and back flange region of the shoe, while preserving the skirt region in the solution-annealed condition. Although cold-heading is a known technique applied to the manufacture of simple articles such as bolts, it was not a typical manufacturing technique for more complex items, such as fuel motor and pump shoes,

particularly considering the type of materials we chose to use. In fact, we contacted several vendors regarding the possibility of providing cold-heading services, and none were producing products of the type at issue, particularly using materials meeting the requirements set forth in paragraph 11 for a fuel environment. These vendors wanted the raw material to be supplied in wire form, as they are focusing on very high production rates. Our alloy was available in bar form.

13. Changing from the previously-adopted manufacturing technique to the cold-heading technique described and claimed in the present application was a substantial undertaking, resulting in considerable time and expense. We would not have adopted the cold-heading technique had it not been for the particular drawbacks with the previous approach of the '475 patent that we ourselves discovered. I find nothing in the asserted references that suggests adopting a cold-heading manufacturing technique as claimed for the manufacture of a wear resistant shoe of the type set forth in the claim.

As supported by the above-stated facts, it is my view that one of ordinary skill in the art, at the time of our invention, would not have found it obvious to modify the prior art in the manner asserted to reject the pending claims.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under section 1001 of Title 18 of United States Code and that such willful and false statements may jeopardize the validity of the application or any patent issued thereon.

4/13/04
DATE

Richard G. Rateick, Jr.
RICHARD G. RATEICK, JR.